

Open Geospatial Consortium, Inc. OpenGIS ® Web Map Service

1 Status of this Memo

This is a description of a Proposed ESE Community Standard.

Distribution of this memo and the referenced standard is unlimited.

2 Change Explanation

Initial RFC Version 0.2.

Change Summary

Major edits driven by Reviewer 1-6 inputs, too numerous to explain one by one.

3 Copyright Notice

Copyright © NASA (2005). All Rights Reserved.

4 Abstract

The purpose of this memo is to nominate the OpenGIS® Web Map Service Implementation Specification (WMS) for adoption as a NASA ESE community standard for disseminating views of raster and vector data (“maps”) via the World Wide Web. WMS uses HTTP and defines several operations that allow a client to discover the functions a server is capable of providing, request a specific “map”, and, optionally, request information about individual features shown on a map.

This nomination is for the most recent version of the WMS specification, version 1.3. Any future installations of WMS should use the most recent version. WMS 1.3 is identical to ISO 19128, which the International Organization for Standardization (ISO) is due to release as an International Standard during calendar year 2005.

5 Table of Contents

1	STATUS OF THIS MEMO	1
2	CHANGE EXPLANATION	1
3	COPYRIGHT NOTICE	1
4	ABSTRACT	2
5	TABLE OF CONTENTS	2
6	INTRODUCTION	2
7	MOTIVATION TO ADOPT THE OGC WMS	3
8	OPENGIS ® WEB MAP SERVICE IMPLEMENTATION SPECIFICATION 1.3	4
9	REFERENCES	4
10	AUTHORS' ADDRESS	4
11	APPENDIX A	

.....	4
12	ATTACHMENTS
.....	6

6 Introduction

The Open Geospatial Consortium, Inc. (OGC) WMS specification is nominated to provide an industry-standard, non-proprietary method of disseminating geospatial information that is supported by many commercial and open source applications. Because of its broad acceptance in the market place, legacy systems can be easily adapted to comply quickly and cheaply. More than 80 companies and organizations, including several that provide open source software, offer solutions for NASA use. The value of WMS is in its simplicity: a single interface is used to issue requests to multiple servers from multiple vendors and open source and then overlay all of the responses for the user to view – ‘layers’ are returned with transparent backgrounds then simply displayed on top of one another by the client.

The WMS specification consists of two mandatory operations and one optional operation. The (mandatory) GetCapabilities operation lets a client query and learn the capabilities of the service provided by a compliant server. The client parses the returned document and creates a user interface display that lists the available data layers, projections, image file format, and symbolization options. To be compliant a server must return at least one of several formats, including .gif, .png, .jpg, and .svg. It may return other formats too. The (mandatory) GetMap interface lets the client request a georegistered picture (a “map”) in one of the image file formats listed in the GetCapabilities reply. Finally, the (optional) GetFeatureInfo operation lets a client request any available information about a pixel location on the map. Users can use the GetFeatureInfo to identify or query the selected objects from map layers.

Though this nomination is for version 1.3 of the WMS specification existing implementations of earlier WMS versions are not made obsolete and it does not require replacing existing 1.0, 1.1 and 1.1.1 implementations. All of the versions of the specification provide the same functionality using the same interfaces. The only impact of having a NASA system that has WMS 1.0, WMS 1.1, WMS 1.1.1 and now WMS 1.3, services in it, is on those clients that need to work with all of them. Commercial and open source practice for WMS clients includes the ability to negotiate versioning of the server and send the proper query to each one, which means version specificity is not a factor.

7 Motivation to Adopt the OGC WMS

Why adopt a standard that has been approved by both International Organization for Standardization (ISO) (the premier legally empowered standards body in the world) and the OGC (the leading provider of geospatial implementation specifications)? Two opportunities: reduced costs for NASA and the user, and broader use of NASA data. NASA is under continual

pressure to operate more efficiently and at the same time engender greater use of its products and services. A recently published Return on Investment study funded by NASA demonstrates the cost effectiveness of not only using standards, but the WMS Specification itself. That study is found at Attachment C. The service orientation that WMS and the overall OGC Service Oriented Architecture (SOA) bring will, over time, relieve NASA of the need to have a custom viewer for each of its data sources. It will simplify the process of adapting legacy systems to an interoperable architecture and also relieve NASA of the high integration costs of having custom interfaces on each of its new systems. One viewer or a set of viewers for communities of practice will be able to display and fuse data from services that did not even exist when they were provided. Integration via shared, industry-standard interfaces, will be easier and often done automatically by software after a new service is simply registered. The use of WMS will also enable citizens to access and exploit the NASA data from their existing desktop and browser software, driving costs down, and use and benefits up.

WMS is an important step into the world of SOA as defined in the Federal Enterprise Architecture. It provides an inexpensive, straight forward way for NASA to evaluate the applicability of a SOA. WMS and other OGC specifications (listed in Attachment B) will extend the reach and use of NASA data to other government departments and the general citizenship, and will lower barriers between internal scientific uses and external applications.

8 OpenGIS ® Web Map Service Implementation Specification 1.3

The specification is included as Attachment A.

http://portal.opengeospatial.org/files/?artifact_id=5316

[RFC Editor's Note: The referenced document will be incorporated into this RFC as a bundled document in a future editorial revision of this RFC.]

9 References

Attachment A includes Normative References.

Informative References:

<http://www.opengeospatial.org/specs/?page=abstract>

10 Authors' Address

Sam A. Bacharach

35 Main Street

Wayland, MA 01778

USA

Tel: 508-655-5858; fax 703-352-7361

email: sbacharach@opengeospatial.org j.smith@foobar.com

11 Appendix A

Glossary of acronyms –

2D	Two Dimensional
AOS	Application Objects Specification
API	Application Programming Interface
AVIRIS	Airborne Visible/Infrared Imaging Spectrometer
BNF	Backus-Naur Form
DAAC	Digital Active Archive Center
ESE	Earth Science Enterprise
ESIP	Earth Science Information Partner
GC	Grid Coverage
GIS	Geographic Information System
GLOBE	Global Learning and Observations to Benefit the Environment
GML	Geography Markup Language
GO-1	Geographic Objects - Version 1
GSFC	Goddard Space Flight Center
HTTP	Hyper Text Transfer Protocol
JPL	Jet Propulsion Laboratory
OGC™	Open Geospatial Consortium, Inc.
OGCRM	OGC Reference Model
ORM	OGC Reference Model
OpenGIS ®	Registered Trademark of the OGC.
OWS	OpenGIS Web Services
PO	Physical Oceanography
ROI	Return On Investment
SFS	OpenGIS ® Simple Feature Implementation Specification
SLD	OpenGIS ® Styled Layer Descriptor Implementation Specification
SOA	Service Oriented Architecture
SQL	Structured Query Language
SVS	Scientific Visualization System
TDB	Technical Document Baseline

URL	Uniform Resource Locator
WCS	OpenGIS ® Web Coverage Service Implementation Specification
WFS	OpenGIS ® Web Feature Service Implementation Specification
WMC	OpenGIS ® Web Map Context Documents Implementation Specification
WMS	OpenGIS ® Web Map Service Implementation Specification See
Attachment A	
XML	eXtensible Markup Language

12 Attachments

Attachment A: OpenGIS ® Web Map Service Implementation Specification 1.3

Attachment B: OGC's Work

Attachment C: NASA Return on Investment Study

Attachment D: Related OGC Specifications

Attachment E: NASA Implementations of the OGC Web Map Service

Attachment A.

OpenGIS ® Web Map Service Implementation Specification 1.3
http://portal.opengeospatial.org/files/?artifact_id=5316

Attachment B. OGC's Work

The full collection of OGC specifications is included to illustrate the depth of the work performed by the consortium and to enable an understanding of the 'architecture' of which WMS is a part. As an international consortium OGC has produced a number of specifications that are related which allows a user to assemble them in new and innovative ways. The architecture itself and the overall scope of OGC are described in the OGC Reference Model. The OGCRM is available at the URL listed in Section 9 References . The existence of this architecture and multiple products that support it insures that NASA will enjoy a wide selection of products and options to implement and expand an SOA.

Title	Version	Date	Description
OpenGIS ® Catalog Services Implementation Specification	2.0	2004-08-02	Defines a common interface that enables diverse but conformant applications to perform discovery, browse and query operations against distributed and potentially heterogeneous catalog servers.
OpenGIS ® Coordinate Transformation Services Implementation Specification	1.0	2001-01-	12 Provides interfaces for general positioning, coordinate systems, and coordinate transformations.
OpenGIS ® Filter Encoding Implementation Specification	1.1	2005-05-03	This document defines an XML encoding for filter expressions based on the BNF definition of the OpenGIS Common Catalog Query Language as described in the OpenGIS Catalog Interface Implementation Specification, Version 1.0 [2].
OpenGIS ® Geography Markup Language Encoding Specification	3.1.1	2005-05-03	The Geography Markup Language (GML) is an XML encoding for the transport and storage of geographic information, including both the geometry and properties of geographic features.
OpenGIS ® GO-1 Application Objects (AOS) Implementation Specification	1.0.0	2005-05-04	The GO-1 Application Objects specification defines a set of core packages that support a small set of Geometries, a basic set of renderable Graphics that correspond to those Geometries, 2D device abstractions (displays, mouse, keyboard, etc.), and supporting classes. Implementation of these APIs will support the needs of many users of geospatial and graphic information. These APIs support the rendering of geospatial datasets, provide fine-grained symbolization of geometries, and support dynamic, event and user driven animation of geo-registered graphics.
OpenGIS ® Grid Coverages (GC) Implementation Specification	1.0	2001-01-12	This specification was designed to promote interoperability between software implementations by data vendors and software vendors providing grid analysis and processing capabilities.

Title	Version	Date	Description
OpenGIS ® OGC Web Services Common Implementation Specification (Common)	1.0	2005-05-03	This document specifies many of the aspects that are, or should be, common to all or multiple OWS interface Implementation Specifications. Those specifications currently include the Web Map Service (WMS), Web Feature Service (WFS), and Web Coverage Service (WCS). These common aspects include: operation request and response contents; parameters included in operation requests and responses; and encoding of operation requests and responses.
OpenGIS ® Simple Features - SQL (SFS)	1.1	1999-05-05	The Simple Feature Specification application programming interfaces (APIs) provide for publishing, storage, access, and simple operations on Simple Features (point, line, polygon, multi-point, etc).
OpenGIS ® Styled Layer Descriptor (SLD) Implementation Specification	1.0	2002-08-19	The SLD is an encoding for how the Web Map Server (WMS 1.0 & 1.1) specification can be extended to allow user-defined symbolization of feature data.
OpenGIS ® Web Coverage Service (WCS) Implementation Specification	1.0	2003-10-16	Extends the Web Map Server (WMS) interface to allow access to geospatial "coverages" that represent values or properties of geographic locations, rather than WMS generated maps (pictures).
OpenGIS ® Web Feature Service (WFS) Implementation Specification	1.1	2005-05-03	The OGC Web Feature Service (WFS) interface is a collection of operations (implemented as messages carried over HTTP) for retrieving and manipulating geographic features. An implementation of the OGC WFS IS allows a client to retrieve and update geospatial data encoded in Geography Markup Language (GML) from one or more Web Feature Services.
OpenGIS ® Web Map Context Documents (WMC) Implementation Specification	1.1	2005-05-03	This document is a companion specification to the OGC Web Map Service Interface Implementation Specification. The present Context specification states how a specific grouping of one or more maps from one or more map servers can be described in a portable, platform-independent format for storage in a repository or for transmission between clients. This description is known as a "Web Map Context Document," or simply a "Context." Presently, context documents are primarily designed for WMS bindings.
OpenGIS ® Web Map Service (WMS) Implementation Specification	1.3	2004-08-02	Provides three operations protocols (GetCapabilities, GetMap, and GetFeatureInfo) in support of the creation and display of registered and superimposed map-like views of information that come simultaneously from multiple sources that are both remote and heterogeneous.

Title	Version	Date	Description
OpenGIS ® Reference Model (ORM)	0.1.2	2003-03-04	The ORM describes a framework for the ongoing work of the OpenGIS Consortium and our specifications and implementing interoperable solutions and applications for geospatial services, data, and applications.
OpenGIS ® Technical Document Baseline (TDB)	1.3	2004-04-22	Spreadsheet of OGC Technical Document Baseline (in update to reflect 05 changes)

Your attention is called to the Styled Layer Descriptor specification which offers a standard way to vary the symbology of a WMS ‘map’ and the WMS Context Document which provides a method to not only ‘save a session’, but pass that session to another user who can then recreate it on their client. Links to both documents are provided in Attachment D, Related OGC Specifications.

Attachment C: NASA ROI study, Dated April 2005 by Booz Allen Hamilton

<http://gio.gsfc.nasa.gov/docs/ROI%20Study.pdf>

This study examines the use of the WMS specification in NASA and concludes that initial costs are higher than using proprietary interfaces, but that life cycle costs are dramatically reduced and flexibility and extensibility are dramatically increased. There is a reasonable expectation that the implementation premium will disappear as more experience is gained with using the specification.

http://portal.opengeospatial.org/files/?artifact_id=3836**Attachment D: Related Open GIS specifications**

OpenGIS ® Styled Layer Descriptor Implementation Specification

https://portal.opengeospatial.org/files/?artifact_id=1188

OpenGIS ® Web Map Context Implementation Specification

https://portal.opengeospatial.org/files/?artifact_id=8618[https://portal.opengeospatial.org/f](https://portal.opengeospatial.org/files/?artifact_id=8618)
[iles/?artifact_id=8618](https://portal.opengeospatial.org/files/?artifact_id=8618)https://portal.opengeospatial.org/files/?artifact_id=8618

Attachment E NASA Implementations of the OGC Web Map Service

[RFC Editor's Note: In a future editorial revision of this RFC, this attachment will be removed and placed into a separate, more extensive *Evidence of Implementation and Operational Use* document.]

There are a number of WMS instances extant in NASA, including the list below. Additionally NASA would benefit from the immediate capability to provide data to the U.S. Geological Survey “The National Map” and the Geospatial One Stop portal as well as the Department of Home Land Security Geospatial Architecture.

A sample of the existing NASA instances:

NASA Earth-Sun Gateway

<http://esg.gsfc.nasa.gov>

NASA / GMU AVIRIS Data Server:

http://viewer.digitalearth.gov/viewer.cgi?addserver=25&service=View+Layer+Menu&context=world_topo_0_1_2.xml&fullcontrol=0&config=&expand=100

Tropical Rain Forest Information Center

GetCapabilities URL prefix: <http://trfic.jpl.nasa.gov/wmt/de.pl>

GSFC Distributed Active Archive Center Map Server

GetCapabilities URL prefix: <http://eosdata.gsfc.nasa.gov/daac-bin/wmtdods>

PO-DAAC-ESIP Map Server

Version: 1.1.1 (10101)

GetCapabilities URL prefix: <http://podaac-esip.jpl.nasa.gov/cgi-bin/esip/de.pl>

JPL World Map Service

Version: 1.1.1 (10101)

GetCapabilities URL prefix: <http://wms.jpl.nasa.gov/wms.cgi>

Lucian Plesea <Lucian.Plesea@jpl.nasa.gov>

ESE-RFC-005
Category: Standards Track
Updates/Obsoletes :None

Sam A. Bacharach
July 2005
OpenGIS ® WMS 1.3

The GLOBE Program Visualization Server

Version: 1.1.1 (10101)

GetCapabilities URL prefix: <http://globe.digitalearth.gov/viz-bin/wmt.cgi>

SVS Image Server <http://aes.gsfc.nasa.gov/>